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Patent Protection and Artificial Intelligence: A Comparative Study of Developed Nations

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ABSTRACT

This paper examines how leading developed jurisdictions protect artificial intelligence related inventions within existing patent law frameworks. It traces the rapid growth and concentration of AI patenting activity and situates it against the TRIPS Agreement obligation to provide patents in all fields of technology, while noting TRIPS silence on the meaning of invention and inventor. The study maps emerging categories of AI related inventions, with particular attention to AI generated inventions, and analyses how core patentability criteria of novelty, inventive step and industrial applicability are applied to data driven and algorithmic technologies. It then conducts a comparative analysis of the United States, the European Patent Office and the United Kingdom on three doctrinal pressure points: inventorship and the requirement of a human inventor, subject matter eligibility for AI algorithms and computer implemented inventions, and sufficiency of disclosure in the context of opaque, black box models and training data. The findings highlight convergence on a human centred conception of inventorship, but divergence on eligibility standards and disclosure expectations, producing legal uncertainty for cross border innovators. The paper concludes by suggesting that clearer guidance on AI specific disclosure and technical contribution is essential to preserve the patent bargain and support balanced AI innovation.

Keywords: *Artificial intelligence patents, TRIPS Agreement, inventorship, subject matter eligibility, sufficiency of disclosure.*

I. INTRODUCTION

A. Background of the Study

Artificial intelligence has shifted from a specialised research domain into a general purpose technology that permeates finance, health, transport, defence, creative industries and public administration. Policy reports from international organisations describe AI as a transformative

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layer in the digital economy, comparable in systemic impact to electricity or the internet, and stress that it is already embedded in global value chains and everyday consumer services.[3]

Patterns of innovation mirror this centrality. Patent based studies show sharp growth in AI related patent families from the early 2000s onward, with machine learning, computer vision and natural language processing as leading clusters. They also identify a concentration of AI patenting activity in a relatively small group of developed jurisdictions and corporate actors, with the United States, Europe, Japan, Republic of Korea and China acting as principal hubs of protection.[4]

The multilateral intellectual property framework has had to absorb this technological shift without explicit AI specific provisions. The TRIPS Agreement obliges World Trade Organization members to make patents available for any inventions, whether products or processes, in all fields of technology, provided they are new, involve an inventive step and are capable of industrial application. It also requires that patent rights be enjoyable without discrimination as to field of technology, yet it remains silent on what counts as an invention or who qualifies as an inventor, which leaves ample space for domestic experimentation on AI.[5]

Specialised fora within the World Intellectual Property Organization have begun to explore these gaps. WIPO's Conversation on Intellectual Property and Artificial Intelligence, structured around a Revised Issues Paper, maps concrete questions raised by AI across patents, copyright, data, trade secrets and designs. The paper highlights concerns about inventorship, subject matter eligibility, disclosure standards and transparency of automated administrative decision making within IP offices, and invites member states to share practice rather than prescribing immediate treaty reform.[6]

Broader digital governance instruments also influence the background against which AI patent protection evolves. The OECD Recommendation on Artificial Intelligence sets out values based and policy principles for trustworthy AI, including human rights, transparency, robustness and accountability. These principles encourage governments to design AI policies, including intellectual property strategies, that support innovation while preventing harm to individuals,

[3] World Intell. Prop. Org., WIPO Technology Trends 2019: Artificial Intelligence 12–15 (2019), https://www.wipo.int/publications/en/details.jsp?id=4386.
[4] Id. at 24–33; see also World Intell. Prop. Org., WIPO Technology Trends 2019: Artificial Intelligence – Executive Summary 3–5 (2019), https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055_exec_summary.pdf.
[5] Agreement on Trade Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.
[6] World Intell. Prop. Org., Revised Issues Paper on Intellectual Property Policy and Artificial Intelligence 3–6, WIPO/IP/AI/2/GE/20/1 REV. (May 29, 2020), https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_ai_2_ge_20/wipo_ip_ai_2_ge_20_1_rev.pdf.

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democratic institutions and competitive markets.[7]

Recent patent landscape work on generative AI underlines both the speed and the concentration of AI innovation. A WIPO patent landscape report finds tens of thousands of generative AI related patent families filed between 2014 and 2023, with particularly rapid growth after the introduction of modern deep neural network architectures behind large language models and image generators. It notes that a handful of corporate and academic applicants, largely from technologically advanced economies, dominate filings and that many inventions combine core models with sector specific applications.[8]

II. CONCEPTUAL AND LEGAL FRAMEWORK

Concept of Artificial Intelligence and AI Generated Inventions

Artificial intelligence in patent law debates usually means computational systems that perform functions associated with human intelligence, like learning from data, recognizing patterns, making predictions and taking decisions with limited human control. Contemporary AI mostly appears as narrow AI, built on machine learning and deep learning models that adapt their parameters when exposed to large training datasets. A recent WIPO paper on AI and IP enforcement describes AI in simple terms as "human intelligence exhibited by machines" and connects it to systems that can learn from experience to find patterns in data.[9]

AI systems relevant for patent protection typically rely on multilayer neural networks, reinforcement learning agents or generative models that create new outputs by re combining complex statistical representations. These architectures do not only automate known processes but also search vast solution spaces in ways that humans cannot realistically do at scale. WIPO's Conversation on Intellectual Property and Artificial Intelligence highlights that such systems shift how innovation occurs, since algorithmic exploration can now contribute directly to problem solving in science, industry and creative sectors, and this shift puts pressure on existing IP policy choices.[10]

Within this context, scholars and policy makers start to distinguish between different kinds of

[7] Organisation for Econ. Co operation & Dev., Recommendation of the Council on Artificial Intelligence 4–6, OECD/LEGAL/0449 (May 22, 2019), https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449.
[8] World Intell. Prop. Org., Patent Landscape Report – Generative Artificial Intelligence (GenAI) 9–12 (2024), https://www.wipo.int/web-publications/patent-landscape-report-generative-artificial-intelligence-genai/en/index.html.
[9] Dennis Collopy, Artificial Intelligence and Intellectual Property Enforcement 5 (World Intell. Prop. Org., WIPO/ACE/16/15, 2024), https://www.wipo.int/edocs/mdocs/enforcement/en/wipo_ace_16/wipo_ace_16_15_presentation.pdf.
[10] World Intell. Prop. Org., WIPO Conversation on Intellectual Property (IP) and Artificial Intelligence: Background Note WIPO/IP/AI/GE/19/INF/4, at 3–6 (Oct. 31, 2019), https://www.wipo.int/edocs/mdocs/mdocs/en/wipo_ip_ai_ge_19/wipo_ip_ai_ge_19_inf_4.pdf.

AI related inventions. WIPO's economic work on "Artificial Intelligence and Intellectual Property" identifies categories such as inventions generated by AI, inventions for AI, inventions using AI as a tool and inventions implemented in AI infrastructure. In particular, AI generated inventions describe outputs where an AI system appears to make a key inventive contribution, for example when it autonomously proposes novel chemical structures or engineering designs without detailed human instructions for each feature. This taxonomy helps to clarify that patent law may treat AI that functions merely as a tool differently from AI that seems to originate core inventive concepts.[11]

Internationally, the TRIPS Agreement sets a high level baseline by requiring that patents be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. However, TRIPS does not define what counts as an "invention" or who qualifies as an "inventor", and it leaves these notions to domestic law and practice. This silence now becomes crucial, because AI generated inventions do not fit easily with traditional assumptions that a natural person conceives the inventive idea while machines only execute it.[12]

In the United States, the debate crystallised around the DABUS applications filed by Dr Stephen Thaler, where the AI system "Device for the Autonomous Bootstrapping of Unified Sentience" was named as sole inventor. In Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022), the Federal Circuit held that under the Patent Act an inventor must be a natural person, so an AI system cannot appear in the inventor field at all. The USPTO's 2024 Inventorship Guidance for AI Assisted Inventions builds on this holding and explains that examiners must still identify a human inventor who made a significant contribution to the claimed subject matter, even when AI tools played a central role in generating the inventive output.[13]

A similar line emerges in Europe. In the European Patent Office cases J 8/20 and J 9/20 concerning the DABUS applications, the Legal Board of Appeal confirmed that the European Patent Convention requires the designation of a natural person as inventor and that an AI machine without legal capacity cannot satisfy this requirement. The EPO press communiqué stresses that Article 81 and Rule 19 EPC together demand a human inventor, which means that even if an AI system autonomously produced the technical teaching, applicants must still

[11] Alexander Cuntz et al., Artificial Intelligence and Intellectual Property: An Economic Perspective 8 11 (World Intell. Prop. Org., Econ. Research Working Paper No. 77, 2023), https://www.wipo.int/publications/en/details.jsp?id=4715.

[12] Agreement on Trade Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.

[13] U.S. Patent & Trademark Office, Inventorship Guidance for AI-Assisted Inventions 1 4 (Feb. 12, 2024), https://www.uspto.gov/sites/default/files/documents/ai-inventorship-memo.pdf.

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identify a human person as inventor for the application to proceed.[14]

In the United Kingdom, the Thaler litigation reached the Supreme Court in Thaler v. Comptroller General of Patents, Designs and Trade Marks [2023] UKSC 49. The Court unanimously held that DABUS could not be an inventor under the Patents Act 1977 and that Dr Thaler could not derive entitlement merely from ownership of the machine. The Court treated the statutory concept of inventor as inherently human and refused to stretch property arguments to fill the conceptual gap, which leaves AI generated inventions patentable only if a human can still be said to devise the inventive concept in law.[15]

Basic Principles of Patent Law Relevant to AI

TRIPS sets the global baseline that shapes how developed nations think about patents for AI technologies. It requires that patents be available for inventions in all fields of technology, if they are new, involve an inventive step and are capable of industrial application. It also asks members not to discriminate by field of technology or place of invention. This opens the door for protection of AI related inventions in principle, but leaves the hard details to national law and practice.[16]

Across major patent systems, the classic trinity of patentability remains central. Novelty, inventive step or non obviousness, and industrial applicability form the main filter that screens AI inventions from the public domain. Leading doctrinal texts describe patents as a bargain where the inventor discloses technical information in exchange for a time limited exclusive right, with these three criteria guarding that bargain from abuse or trivial claims.[17]

Indian patent law reflects the same structure and therefore helps to show how a TRIPS compliant system frames AI inventions. The Patents Act 1970 defines an "invention" as a new product or process that involves an inventive step and is capable of industrial application. Training materials prepared for patent officials in India explain that these three elements - novelty, inventive step and industrial applicability - are the key criteria for patent examination and must all be satisfied before protection is granted, even for computer implemented or AI

[14] Press Communiqué, Eur. Patent Office Boards of Appeal, Cases J 8/20 and J 9/20: Designation of an Artificial Intelligence System as Inventor in a European Patent Application (July 6, 2022), https://www.epo.org/en/law-and-practice/boards-of-appeal/communications/press-communique-6-july-2022-decision-j-820-ai.
[15] Thaler v. Comptroller General of Patents, Designs and Trade Marks [2023] UKSC 49 (appeal taken from EWCA (Civ)), https://www.supremecourt.uk/cases/uksc-2021-0201.html.
[16] Agreement on Trade Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.
[17] W.R. Cornish, David Llewelyn & Tanya Aplin, Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights (9th ed. 2019).

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based solutions.[18]

In Europe, the core principles appear again but interact with specific exclusions that matter a lot for AI. The European Patent Convention grants patents only for inventions that are new, involve an inventive step and are susceptible of industrial application, yet it also lists mathematical methods and schemes for mental acts as not being "inventions" as such. The EPO Guidelines on artificial intelligence and machine learning describe AI models and algorithms as abstract mathematical methods on their own, and therefore only patentable when they contribute to a further technical purpose beyond mere data processing or classification as such.[19]

The EPO has developed the "technical character" and COMVIK approach to implement these principles in practice for computer implemented and AI inventions. Under this approach, only features that contribute to a technical solution of a technical problem can support inventive step. EPO policy material on AI explains that improvements to a neural network that merely refine a business rule or improve accuracy of a non technical prediction do not count, but modifications that reduce memory usage in an embedded vision system or improve control of an industrial process may qualify as a technical contribution.[20]

United States law follows the same high level principles but frames them through the lens of subject matter eligibility and judicial exceptions. Section 101 of the Patent Act is interpreted to exclude abstract ideas, which for software and AI often means mathematical concepts and certain methods of organizing human activity. The 2019 Revised Patent Subject Matter Eligibility Guidance groups abstract ideas in these categories and instructs examiners that a claim directed to a mathematical concept, such as a machine learning model, must integrate that concept into a "practical application", otherwise it remains ineligible even if it is novel and non obvious.[21]

Patentability Requirements in the Context of AI

In AI related inventions, the classic patentability triad of novelty, inventive step or non obviousness, and industrial applicability still supplies the central legal filter in developed

[18] Bouddhik Aagman, Understanding Novelty, Inventive Step and Industrial Applicability 4 6 (Gov't of India 2025), https://mcrhrdi.gov.in/2025/itpepd/week4/Understanding%20Novelty%2C%20Inventive%20step%20and%20industrial%20applicability.pdf.

[19] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1 (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.

[20] Eur. Patent Office, Artificial Intelligence - Patent Practice at the EPO (2025), https://www.epo.org/en/news-events/in-focus/ict/artificial-intelligence.

[21] U.S. Patent & Trademark Office, 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019), https://www.uspto.gov/sites/default/files/documents/2019%20USPTO%20BM%20101-2019%20PEG.pdf.

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jurisdictions. Yet, examiners and courts apply these tests through additional concepts such as "technical character" in Europe and "subject matter eligibility" in the United States, which strongly affect the fate of algorithmic and data driven claims.[22]

Novelty analysis in AI patents usually follows ordinary rules, but prior art can be unusually dense and scattered across conference papers, open source repositories and technical standards. The WIPO Technology Trends report on artificial intelligence notes that machine learning filings have surged since 2010, and that public pre print platforms and code repositories make anticipatory disclosures more likely, so applicants must draft claims with careful attention to incremental differences in model architecture, training regimes or deployment context.[23]

Inventive step, or non obviousness, creates sharper tensions for AI because many improvements seem to flow naturally from standard optimisation practices. EPO case law on computer implemented inventions applies the COMVIK approach, which assesses inventive step solely on features that contribute to a technical solution of a technical problem. The EPO Guidelines explain that an AI algorithm that merely improves a business decision or recommends content to users does not normally involve a technical contribution, whereas a modified neural network that reduces latency in a real time control system can support inventive step.[24]

In the United States, the non obviousness inquiry under 35 U.S.C. § 103 interacts with the subject matter filter under § 101. The USPTO's examination guidelines on AI and emerging technologies emphasize that claims reciting machine learning models or training methods will first face the Alice two step test, which screens out abstract ideas unless they are integrated into a practical application. Only after passing this gate will examiners fully consider differences over prior art under the Graham factors, including the level of ordinary skill in fast moving AI fields.[25]

Industrial applicability, or utility, normally raises fewer objections for AI inventions, because most machine learning systems are designed for concrete tasks such as image recognition, medical diagnosis support or process optimisation. However, disclosure must still show a specific, substantial and credible use. The UK Manual of Patent Practice notes that a claim to a generic algorithm for "intelligent reasoning" may fail if it does not identify a clear application,

[22] Lionel Bently & Brad Sherman, Intellectual Property Law 456–60 (5th ed. 2022).
[23] World Intell. Prop. Org., WIPO Technology Trends 2019: Artificial Intelligence 18–27 (2019), https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf.
[24] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1, 3.3.2 (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.
[25] U.S. Patent & Trademark Office, Intellectual Property and Artificial Intelligence: A USPTO Perspective on Nonobviousness 2–5 (2020), https://www.uspto.gov/sites/default/files/documents/USPTO_AI-Nonobviousness.pdf.

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while a claim to an AI system for fault detection in power grids will satisfy the industrial applicability requirement due to its tangible technical function.[26]

Subject matter exclusions remain a decisive hurdle. The European Patent Convention excludes "programs for computers as such" and "mathematical methods as such" from patent protection. EPO guidance on AI states that pure machine learning models and training methods are often mathematical methods and thus excluded, unless the claim as a whole serves a further technical purpose, for example controlling a hearing aid or compressing digital video. This means that applicants must frame AI inventions as technical applications, not as abstract predictive engines.[27]

Doctrinal Issues

1. Inventorship and the Role of Human Contribution

Inventorship in patent law still rests on the idea of a natural person who conceives the inventive concept. Statutes in developed jurisdictions use terms such as "inventor", "actual deviser" or "natural person", and courts read these expressions in a strictly human sense. The Federal Circuit in *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022), held that the U.S. Patent Act requires an inventor to be a natural person, which excludes an AI system even where it generated the technical solution.[28]

European patent doctrine follows the same path. The European Patent Convention requires the designation of an inventor and the EPO has treated this as referring only to a human being with legal personality. In the DABUS appeals, cases J 8/20 and J 9/20, the Legal Board of Appeal confirmed that an AI system cannot be named as inventor, and that an application that lists a machine alone does not satisfy Article 81 EPC and Rule 19 EPC.[29]

United Kingdom law adopts an "actual deviser" test, yet still views inventorship as a human centered notion. In *Thaler v. Comptroller General of Patents* [2023] UKSC 49, the Supreme Court held that DABUS was not a person and therefore could not be an inventor under the Patents Act 1977. The Court further rejected the argument that the owner of the AI becomes entitled simply because he owns the machine, which leaves a doctrinal gap where highly

[26] U.K. Intell. Prop. Office, Manual of Patent Practice § 4.05.1–4.09 (2024), https://www.gov.uk/guidance/manual-of-patent-practice.
[27] Eur. Patent Office, Artificial Intelligence and Machine Learning (2024), https://www.epo.org/en/news-events/in-focus/ict/artificial-intelligence.
[28] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022).
[29] Press Communiqué, Eur. Patent Office Boards of Appeal, Cases J 8/20 and J 9/20: Designation of an Artificial Intelligence System as Inventor in a European Patent Application (July 6, 2022), https://www.epo.org/en/law-and-practice/boards-of-appeal/communications/press-communique-6-july-2022-decision-j-820-ai.

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autonomous AI outputs exist but no human can honestly claim to have devised the inventive concept in the traditional way.[30]

Policy guidance in the United States now tries to manage this gap without altering the basic doctrine. The USPTO's 2024 Inventorship Guidance for AI Assisted Inventions explains that a natural person must make a "significant contribution" to the conception of the claimed invention. It states that merely posing a general problem to an AI model or simply recognising value in an AI output does not make someone an inventor. Examiners must instead look for concrete contributions, for example designing the training strategy, selecting input parameters or shaping the final claim language.[31]

European practice uses a similar but less formalised approach when AI tools support inventive work. The EPO's public material on artificial intelligence and patent practice stresses that AI systems remain tools that assist human inventors rather than independent creators. Applicants must still identify at least one human inventor, even where AI generated candidate solutions in a largely automated search process. This position preserves classical doctrines on entitlement and employee inventions, since only human inventors and their successors in title can own European patents.[32]

Academic commentary highlights deeper doctrinal tensions behind these policy choices. Some scholars note that the traditional concept of inventorship rests on mental acts of conception and the "flash of genius" model, which fits poorly with iterative and data driven AI research. Others argue that broad teams now develop, train and deploy AI systems, so attributing inventorship to one or two individuals may not reflect the distributed nature of contribution in large AI projects. Proposals range from treating AI as a sophisticated tool, with inventorship resting on those who design and direct it, to more radical views that suggest new categories of related rights for AI generated outputs.[33]

2. Subject Matter Eligibility of AI Related Inventions

Subject matter eligibility decides whether an AI related claim even enters the patentability analysis. Developed nations build this filter on statutory language, but then carve out exclusions for abstract ideas, mathematical methods or computer programs as such. TRIPS only requires

[30] Thaler v. Comptroller General of Patents, Designs and Trade Marks [2023] UKSC 49, https://www.supremecourt.uk/cases/uksc-2021-0201.html.
[31] U.S. Patent & Trademark Office, Inventorship Guidance for AI-Assisted Inventions 1–4 (Feb. 12, 2024), https://www.uspto.gov/sites/default/files/documents/ai-inventorship-memo.pdf.
[32] Eur. Patent Office, Artificial Intelligence Patent Practice at the EPO (2024), https://www.epo.org/en/news-events/in-focus/ict/artificial-intelligence.
[33] Ryan Abbott, The Reasonable Robot: Artificial Intelligence and the Law 77–102 (2020).

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that patents be available in all fields of technology and allows limited exclusions, so national law still retains wide discretion on how far to protect AI based subject matter.[34]

United States law expresses the eligibility test through 35 U.S.C. § 101 and a set of "judicial exceptions". The Supreme Court in *Mayo* and *Alice* treats laws of nature, natural phenomena and abstract ideas as excluded categories, and many AI or machine learning claims fall close to the abstract idea line. *Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208 (2014), frames the two step test. First, decide whether the claim is directed to an abstract idea. Second, decide whether there is "significantly more" that transforms that idea into a patent eligible application.[35]

USPTO examination practice applies this structure in a more detailed way. The 2019 Revised Patent Subject Matter Eligibility Guidance groups abstract ideas into mathematical concepts, certain methods of organising human activity, and mental processes. Many AI inventions use mathematical models and optimisation algorithms, so they are first treated as reciting a mathematical concept. Examiners then look for a practical application, for example an AI model embedded in a medical imaging system, before they accept eligibility. This forces applicants to draft AI claims around concrete technological implementations.[36]

Subject matter eligibility in Europe rests on a different doctrinal formula but reaches similar concerns. Article 52 of the European Patent Convention excludes "programs for computers as such", "mathematical methods" and "schemes, rules and methods for performing mental acts or doing business". The EPO Guidelines explain that artificial intelligence and machine learning are usually based on computational models and algorithms and are therefore treated as mathematical methods as such. Eligibility is restored only when the claimed subject matter has a further technical purpose beyond the algorithm itself, such as image processing in a self driving car or controlling a manufacturing process.[37]

The EPO's COMVIK approach brings this into the inventive step stage as well, but the technical character assessment already acts as a subject matter gate. Guidance on AI gives examples. A neural network that classifies digital images to improve a compression rate for video streaming may be eligible, because it serves a technical purpose in signal processing. A model that ranks posts in a social media feed, mainly to drive user engagement, will generally be treated as a non

[34] Agreement on Trade Related Aspects of Intellectual Property Rights art. 27(1)–(2), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.
[35] Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[36] U.S. Patent & Trademark Office, 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019), https://www.uspto.gov/sites/default/files/documents/2019_ptab_peg.pdf.
[37] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1 (Artificial Intelligence and Machine Learning) (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.

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technical method of doing business and remain excluded. This shows how technical effect and technical purpose language shapes AI eligibility in Europe.[38]

Indian law uses a statutory exclusion rather than an open ended "abstract idea" doctrine. Section 3(k) of the Patents Act 1970 declares that a mathematical or business method or "a computer programme per se or algorithms" are not inventions. The Guidelines for Examination of Computer Related Inventions interpret this clause and permit protection only where the claim as a whole shows a technical application or a technical contribution, such as control of industrial equipment or improved internal functioning of the computer. For AI related inventions, this pushes applicants to emphasise hardware integration and concrete technical outcomes instead of abstract predictive analytics.[39]

The United Kingdom follows the European structure but expresses it in slightly different language. Section 1(2) of the Patents Act 1977 mirrors EPC exclusions and UK courts have developed the Aerotel four step test to decide whether a claim relates to excluded subject matter. The UK Manual of Patent Practice explains that computer implemented inventions, including AI systems, must make a technical contribution beyond the normal interactions of program and computer. Claims that implement a machine learning model for trading or advertising strategy will usually fail, while claims that improve the operation of a device or network have a better

3. Sufficiency of Disclosure and Black Box Algorithms

Sufficiency of disclosure, or enablement, requires that the patent specification teach the skilled person how to carry out the invention across the full scope of the claims without undue burden. In European practice this duty is captured in Article 83 EPC and elaborated in the Guidelines, which insist on a detailed description of at least one way of performing the invention so that the skilled person can put it into practice in a realistic manner.[40]

Black box AI systems strain this doctrine because they often operate through highly complex internal representations that even their designers cannot fully explain. The opacity of deep learning models, and the sensitivity of outputs to training data and hyperparameters, means that a bare functional description, such as "a neural network configured to classify images with improved accuracy", may not really enable a skilled person to reproduce the technical effect

[38] Eur. Patent Office, Artificial Intelligence and Machine Learning (AI and ML) (2024), https://www.epo.org/en/news-events/in-focus/ict/artificial-intelligence.

[39] Office of the Controller General of Patents, Designs & Trade Marks, Guidelines for Examination of Computer Related Inventions (CRI) 5–9 (2017), https://ipindia.gov.in/writereaddata/Portal/Images/pdf/Guidelines_for_Examination_of_Computer_Related_Inventions_cri.pdf.

[40] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. F, ch. III, 1 (2025), https://www.epo.org/en/legal/guidelines-epc/2025/f_iii_1.html.

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over the whole breadth of the claim. Scholarly analysis now argues that AI inventions need richer disclosure of model structure, training regimes and performance conditions, otherwise the patent becomes a shield over an undisclosed trade secret rather than a genuine technological teaching.[41]

The scale of AI patenting makes this sufficiency problem very concrete. WIPO's Technology Trends report on artificial intelligence finds that machine learning appears in a large share of AI related patent families and that filings in deep learning and neural networks have grown at very high annual rates. The report also notes that many of these specifications use broad functional language to claim families of models and applications, which heightens the risk that disclosures will not permit routine implementation across the claim scope.[42]

European doctrine has begun to respond in a more explicit way. The EPO Guidelines on sufficiency warn that disclosure is insufficient where the skilled person must carry out a genuine research programme based on trial and error with limited chances of success. They now highlight that, for inventions relying on mathematical methods and training datasets, the application must describe these elements in enough detail to reproduce the claimed technical effect across the full range, otherwise the claim may be treated as an invitation to further research rather than an enabling teaching. This guidance directly targets black box type AI claims that hide crucial information about data selection or training strategies.[43]

The United Kingdom Supreme Court's decision in *Regeneron Pharmaceuticals Inc v. Kymab Ltd* [2020] UKSC 27, although not an AI case, has major implications for broad AI claims. The Court held that sufficiency requires the patent to enable the skilled person to make substantially all embodiments falling within the claim, not just a subset that happened to be exemplified. That logic suggests that an AI claim which covers a wide class of architectures or training configurations, but only teaches how to implement a narrow corner of that class, may be vulnerable for lack of sufficiency once courts apply the Regeneron standard.[44]

[41] M. Aboy, The Sufficiency of Disclosure of AI Inventions, 19 J. Intell. Prop. L. & Prac. 834 (2024), https://academic.oup.com/jiplp/article/19/11/834/7737406.
[42] World Intell. Prop. Org., WIPO Technology Trends 2019: Artificial Intelligence 30–35 (2019), https://www.wipo.int/publications/en/details.jsp?id=4386.
[43] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. F, ch. III, 3 (Insufficient Disclosure) (2025), https://www.epo.org/en/legal/guidelines-epc/2025/f_iii_3.html.
[44] Regeneron Pharms. Inc. v. Kymab Ltd [2020] UKSC 27, https://www.supremecourt.uk/cases/uksc-2018-0131.html.

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III. Comparative overview of patent protection for AI in developed nations

A. United States

The United States framework for AI related patents still rests on the general Patent Act provisions on patentable subject matter, novelty, non obviousness and disclosure, rather than any AI specific statute. Section 101 defines the broad categories of patent eligible subject matter, while sections 102, 103 and 112 govern novelty, non obviousness and enablement, and all of them apply equally to software and AI inventions.[45]

The key doctrinal pressure point for AI inventions in the United States remains subject matter eligibility under section 101 and the Supreme Court's "judicial exceptions". *Alice Corp. v. CLS Bank Int'l* builds on *Mayo* to exclude abstract ideas, laws of nature and natural phenomena unless the claims add "significantly more" than the exception itself. Many AI claims recite mathematical models, data processing and predictive analytics, so they must pass through this two step *Alice/Mayo* filter before the USPTO even reaches traditional patentability requirements.[46]

USPTO examination has been structured by the 2019 Revised Patent Subject Matter Eligibility Guidance. This document groups abstract ideas into three types – mathematical concepts, certain methods of organising human activity and mental processes – and instructs examiners that many AI inventions fall initially into the mathematical concepts group. It then asks whether the claim integrates that abstract idea into a "practical application", for example by improving the operation of a medical imaging device or a networked sensor system, before treating it as eligible.[47]

The October 2019 Patent Eligibility Guidance Update refines this approach and remains important for AI. It responds to public comments and gives examples that show how computer implemented inventions can move from ineligible mathematical methods to eligible technical applications. The Update explains that improved computer performance or control of another technical process can supply the necessary practical application, while mere automation of a business or mental process will not. AI applicants therefore tend to frame claims around system

[45] 35 U.S.C. §§ 101–103, 112 (2024).
[46] Alice Corp. v. CLS Bank Int'l, 573 U.S. 208 (2014).
[47] 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019), https://www.federalregister.gov/documents/2019/01/07/2018-28282/2019-revised-patent-subject-matter-eligibility-guidance.

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architecture and technical improvements rather than around abstract prediction tasks.[48]

Recent guidance has focused specifically on subject matter eligibility for AI inventions. In 2024 the USPTO issued a subject matter eligibility update that discusses how examiners should assess whether AI claims recite abstract ideas and whether they improve computer functioning or another technology. That document emphasises that machine learning models, training methods and inference procedures may be abstract ideas at step one, but can still be eligible when they form part of an integrated technical solution, illustrated by new examples added to the MPEP.[49]

Enablement and written description doctrine also shape AI patents in the United States. In *Amgen Inc. v. Sanofi* the Supreme Court held that broad functional genus claims are invalid if they require the skilled person to undertake a significant research project rather than follow concrete teaching. Although the case involved antibodies, its reasoning that "the more a party claims, the more it must enable" has direct consequences for AI claims that attempt to monopolise all models achieving a functional result without disclosing representative architectures, datasets and training regimes.[50]

Inventorship doctrine for AI has been clarified through litigation and administrative guidance. In *Thaler v. Vidal* the Federal Circuit held that an "inventor" under the Patent Act must be a natural person, so an AI system such as DABUS cannot be named as inventor on a U.S. patent application. The decision leaves open patent protection for AI assisted inventions, but it closes the door on machine inventors as a matter of statutory interpretation.[51]

B. European Union and European Patent Office

European patent protection for AI rests on the structure of the European Patent Convention and the central examination practice of the European Patent Office. Article 52 EPC grants patents for inventions in all fields of technology that are new, involve an inventive step and are susceptible of industrial application, but it excludes discoveries, mathematical methods and programs for computers as such.[52]

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[48] October 2019 Patent Eligibility Guidance Update, 84 Fed. Reg. 55,942 (Oct. 18, 2019), https://www.federalregister.gov/documents/2019/10/18/2019-22782/october-2019-patent-eligibility-guidance-update.

[49] U.S. Patent & Trademark Office, Guidance Update on Patent Subject Matter Eligibility in Relation to Artificial Intelligence Inventions 2–6 (2024), https://www.uspto.gov/patents/laws/examination-policy/subject-matter-eligibility.

[50] Amgen Inc. v. Sanofi, 598 U.S. 594 (2023).

[51] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022), https://www.cafc.uscourts.gov/opinions-orders/21-2347.OPINION.8-5-2022_1988142.pdf.

[52] European Patent Convention art. 52(1)–(2), Oct. 5, 1973, as amended, https://www.epo.org/en/legal/epc/2020/a52.html.

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Artificial intelligence and machine learning are described in the EPO Guidelines as computational models and algorithms that usually fall within the category of mathematical methods. The Guidelines in section G II 3.3.1 state that such methods are excluded "as such" when they are claimed in abstract form, without a link to a technical purpose or technical implementation that goes beyond ordinary data processing.[53]

The EPO therefore relies on the notion of "technical character" to admit AI claims into the patent system. Computer implemented inventions that use technical means, like a programmed processor or a sensor network, can pass the first hurdle of Article 52 and qualify as inventions. Commentary on European software patents often describes this as a two hurdle scheme, where eligibility depends on technical character at the first stage and inventive step depends on whether technical features contribute to solving a technical problem at the second stage.[54]

The COMVIK line of decisions refines this analysis for mixed claims that combine technical and non technical elements, which is common in AI and data driven inventions. Under this approach, only claim features that contribute to a technical effect are considered for inventive step. Case law and EPO summaries on artificial intelligence point out that a machine learning model will support inventive step if it improves, for example, the control of an industrial process or the internal functioning of a computer, but not if it only optimises a pricing rule or a display of recommendations.[55]

European practice has also started to address sufficiency and black box AI systems more explicitly. Revised Guidelines on sufficiency stress that the application must enable the skilled person to reproduce the claimed technical effect over the whole scope, and that where the effect depends on special properties of the training data these properties should be disclosed. Legal alerts on the 2024 and 2025 updates explain that this language aims at AI claims that hide critical information about data selection and training strategies behind broad functional wording.[56]

C. United Kingdom

The United Kingdom grounds patent protection for AI in the Patents Act 1977, interpreted in harmony with European patent law but with its own statutory test and case law. Section 1

[53] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1 Artificial Intelligence and Machine Learning (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.
[54] 4iP Council, Patentability of Computer Programs in Europe 4–8 (2020), https://www.4ipcouncil.com/application/files/2816/1304/3496/Patentability_of_Computer_Programs_in_Europe.pdf.
[55] Eur. Patent Office, Case Law of the Boards of Appeal, I.D.9.2.12(e) Artificial Intelligence and Machine Learning (2025), https://www.epo.org/en/legal/case-law/2025/clr_i_d_9_2_12_e.html.
[56] K&L Gates, Updated Guidelines for Patent Examination in the European Patent Office Create Uncertainty (May 13, 2024), https://ktslaw.com/en/Insights/Alert/2024/5/Updated-Guidelines-for-Patent-Examination-in-the-European-Patent-Office-Create-Uncertainty.

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requires that an invention be new, involve an inventive step, be capable of industrial application, and not fall within the excluded categories in section 1(2), which include computer programs and mathematical methods as such.[57]

The UK Intellectual Property Office uses the Manual of Patent Practice to align examination practice with this framework and with the European Patent Convention. Section 1 of the Manual explains that the exclusions in section 1(2) are treated as "things which are not to be regarded as inventions" and that the approach to excluded subject matter is derived from the Court of Appeal's decision in *Aerotel Ltd v Telco Holdings Ltd* (Aerotel/Macrossan). The Manual also stresses that many computer implemented inventions, including those involving artificial intelligence and computer simulation, relate to mathematical methods and therefore must show a technical contribution to avoid exclusion.[58]

UK courts apply the Aerotel four step test when deciding whether an AI related claim falls foul of section 1(2). The test asks the decision maker to construe the claim, identify the actual contribution, determine whether that contribution falls solely within excluded subject matter, and consider whether it is nevertheless technical. The Manual summarises that this test, confirmed in later cases such as *Symbian Ltd's Application* and *HTC v Apple*, remains the definitive approach. For AI inventions, this means that a neural network which only implements a trading strategy or a recommendation scheme will normally be excluded, while a model that improves the internal functioning of a computer or the control of a technical process may clear the subject matter hurdle.[59]

The UKIPO has issued dedicated Guidelines for examining patent applications relating to AI, first published in 2022 and updated after the Court of Appeal's judgment in *Emotional Perception AI Ltd v Comptroller-General of Patents*. These Guidelines set out the legal framework and then provide scenarios that show how examiners will treat AI inventions which use machine learning for classification, prediction, optimisation or control. The updates in January 2025 explain how the *Emotional Perception* decisions affect assessment of excluded subject matter and add examples where AI systems that process signals in a technical way, such as audio processing in recommendation engines, can amount to a technical contribution even if they also serve commercial aims.[60]

[57] Patents Act 1977, c. 37, § 1(1)–(2) (UK), https://www.legislation.gov.uk/ukpga/1977/37/section/1.
[58] U.K. Intell. Prop. Off., Manual of Patent Practice: Section 1 Patentability ¶¶ 1.02–1.08, 1.29.5 (19 Feb. 2016, as updated), https://www.gov.uk/guidance/manual-of-patent-practice-mopp/section-1-patentability.
[59] Id. ¶¶ 1.07–1.09.2 (discussing Aerotel Ltd v Telco Holdings Ltd & Macrossan's Application [2007] RPC 7 (CA), Symbian Ltd's Application [2009] RPC 1 and HTC Europe Co Ltd v Apple Inc [2013] EWCA Civ 451).
[60] U.K. Intell. Prop. Off., Guidelines for Examining Patent Applications Relating to Artificial Intelligence (AI) (22

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Inventorship for AI related patents has been clarified at the highest judicial level. In *Thaler v Comptroller-General of Patents, Designs and Trade Marks* [2023] UKSC 49, the Supreme Court held that an inventor under the 1977 Act must be a natural person and that an AI system such as DABUS cannot be named as inventor. The Court rejected the argument that the owner or creator of the machine could claim entitlement without being the actual deviser of the invention, and confirmed that the Act does not provide for the grant of a patent without a named human inventor at all. This locks the UK position that AI may assist, but never replace, human inventorship.[61]

IV. FINDINGS AND SUGGESTIONS

The comparative study shows that developed patent systems broadly comply with the TRIPS requirement to grant patents in all fields of technology, including AI, yet they diverge sharply in how they define patent eligible subject matter and structure doctrinal filters. The baseline of novelty, inventive step or non obviousness and industrial applicability remains stable across the United States, Europe and the United Kingdom, but each system layers this with its own tests on abstract ideas, computer programs and technical character, which makes outcomes for similar AI claims uneven across jurisdictions.[62]

A strong convergence appears on the question of inventorship. The United States, through *Thaler v. Vidal* and subsequent USPTO inventorship guidance on AI assisted inventions, insists that only natural persons can be inventors and treats AI systems as tools that support human conception of inventions.[63] The European Patent Office in the DABUS cases J 8/20 and J 9/20, and the UK Supreme Court in *Thaler v. Comptroller-General of Patents*, adopt the same position and reject any possibility of naming an AI system as inventor or deriving entitlement purely from machine ownership.[64] This alignment secures a human centred model of inventive responsibility, but leaves unresolved scenarios in which AI generated outputs arguably outstrip

Sept. 2022, updated 30 Jan. 2025), https://www.gov.uk/government/publications/examining-patent-applications-relating-to-artificial-intelligence-ai-inventions.

[61] Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49 (appeal taken from [2021] EWCA Civ 1374), https://www.supremecourt.uk/cases/uksc-2021-0201.html.

[62] Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.

[63] U.S. Patent & Trademark Office, Inventorship Guidance for AI-Assisted Inventions 1–3 (Feb. 12, 2024), https://www.uspto.gov/sites/default/files/documents/ai-inventorship-memo.pdf.

[64] Eur. Patent Office, Press Communiqué on Decisions J 8/20 and J 9/20: Designation of an Artificial Intelligence System as Inventor in a European Patent Application (July 6, 2022), https://www.epo.org/en/law-and-practice/boards-of-appeal/communications/press-communique-6-july-2022-decision-j-820-ai; Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49, https://www.supremecourt.uk/cases/uksc-2021-0201.html.

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any clearly identifiable human "flash of conception".

At the level of subject matter eligibility, the study identifies significant doctrinal fragmentation. United States law relies on the *Alice/Mayo* framework and a broad idea of "abstract ideas", now adapted to AI through USPTO guidance that asks whether machine learning elements are integrated into a practical technological application.[65] The EPO instead starts from the statutory exclusion of mathematical methods and computer programs as such and uses the technical character and COMVIK approach to decide whether AI features contribute to a technical solution of a technical problem.[66] UK practice, built on section 1(2) of the Patents Act 1977 and the Aerotel test, shadows the EPO line but expresses it in different language. As a result, the same type of AI model may be treated as a patentable technical contribution in one forum and as an excluded abstract method in another, which creates uncertainty for cross border innovators.

The findings also point to a growing stress on sufficiency of disclosure in AI cases. European guidelines now emphasise that where the technical effect of a machine learning model depends on particular characteristics of the training data, those characteristics must be disclosed unless they are obvious to the skilled person, otherwise the claim risks being an invitation to a research programme rather than an enabling teaching.[67] In the United States, decisions such as *Amgen v. Sanofi* signal a stricter approach to broad functional claiming, which can directly affect AI patents that claim all models achieving a certain result without disclosing representative architectures and training pathways. Academic analysis and policy material converge on the concern that black box AI patents can weaken the patent bargain and obstruct follow on research if disclosure remains too thin and functional.[68]

V. CONCLUSION

The comparative study shows that patent law in developed nations has absorbed artificial intelligence into the category of patentable technology while leaving many structural tensions unresolved. TRIPS sets only a thin multilateral frame by requiring that patents be available for inventions in all fields of technology that are new, involve an inventive step and are capable of

[65] 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019); U.S. Patent & Trademark Office, Artificial Intelligence (AI) Guidance Updates 2–5 (Sept. 10, 2024), https://www.uspto.gov/sites/default/files/documents/business-methods-ai-guidance-sept-2024.pdf.
[66] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1 Artificial Intelligence and Machine Learning (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.
[67] K&L Gates, Updated Guidelines for Patent Examination in the European Patent Office Create Uncertainty (May 13, 2024), https://ktslaw.com/en/Insights/Alert/2024/5/Updated-Guidelines-for-Patent-Examination-in-the-European-Patent-Office-Create-Uncertainty.
[68] M. Aboy, The Sufficiency of Disclosure of AI Inventions, 19 J. Intell. Prop. L. & Prac. 834 (2024).

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industrial application, without defining invention, inventor or technical field in AI specific terms.[69] This open texture has allowed domestic and regional systems to respond to AI through doctrine and guidance rather than through treaty reform.

A clear point of convergence lies in the treatment of inventorship. United States law, through the Federal Circuit decision in *Thaler v. Vidal*, reads the Patent Act as limited to natural person inventors and refuses to accept an AI system as an inventor of record.[70] The European Patent Office, in the DABUS appeal J 8/20, reaches the same conclusion and holds that an artificial intelligence machine without legal capacity cannot be designated as inventor for a European patent application.[71] The UK Supreme Court in *Thaler v. Comptroller-General of Patents* confirms this human centered reading of inventorship under the Patents Act 1977 and rejects entitlement claims based merely on ownership of an AI system.[72] Across these jurisdictions, exclusive rights in AI related inventions thus continue to attach to human actors, even when machines contribute heavily to ideation and design.

Subject matter eligibility emerges as the main field of divergence. In the United States, the 2019 Revised Patent Subject Matter Eligibility Guidance interprets *Alice* and *Mayo* by classifying abstract ideas into mathematical concepts, certain methods of organizing human activity and mental processes, and then asking whether an AI related claim integrates such a concept into a practical application.[73] At the EPO, AI and machine learning are treated in the Guidelines as computational models and algorithms that are per se of an abstract mathematical nature, and only become eligible when they form part of a technical solution to a technical problem.[74] In the United Kingdom, the Manual of Patent Practice applies section 1(2) of the 1977 Act and the Aerotel test so that AI inventions must still show a technical contribution beyond excluded subject matter.[75] Innovators therefore face a patchwork in which similar machine learning architectures can be classified as technical in one forum and as unpatentable abstraction in

[69] Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, https://www.wto.org/english/docs_e/legal_e/27-trips_04c_e.htm.

[70] Thaler v. Vidal, 43 F.4th 1207 (Fed. Cir. 2022), https://www.bitlaw.com/source/cases/patent/Thaler.html.

[71] Press Communiqué, Eur. Patent Office Boards of Appeal, Cases J 8/20 and J 9/20: Designation of an Artificial Intelligence System as Inventor in a European Patent Application (July 6, 2022), https://www.epo.org/en/law-and-practice/boards-of-appeal/communications/press-communique-6-july-2022-decision-j-820-ai.

[72] Thaler v. Comptroller-General of Patents, Designs and Trade Marks [2023] UKSC 49, https://www.supremecourt.uk/cases/uksc-2021-0201.html.

[73] 2019 Revised Patent Subject Matter Eligibility Guidance, 84 Fed. Reg. 50 (Jan. 7, 2019), https://www.federalregister.gov/documents/2019/01/07/2018-28282/2019-revised-patent-subject-matter-eligibility-guidance.

[74] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. G II, 3.3.1 Artificial Intelligence and Machine Learning (2025), https://www.epo.org/en/legal/guidelines-epc/2025/g_ii_3_3_1.html.

[75] U.K. Intell. Prop. Off., Manual of Patent Practice: Section 1 Patentability (2024), https://www.gov.uk/guidance/manual-of-patent-practice-mopp/section-1-patentability.

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another.

The analysis also underlines the growing importance of sufficiency of disclosure in AI cases. EPO guidance on sufficiency explains that a specification is not enabling if the skilled person must conduct a research program with limited prospects of success and stresses that, where a technical effect depends on specific properties of the training data or model, these properties must be described in the application.[76] The Supreme Court of the United States in *Amgen Inc. v. Sanofi* similarly insists that broad functional claims fail when they require undue experimentation across their full scope, and restates that the more a patentee claims, the more it must enable.[77] Scholarly work on the sufficiency of disclosure for AI inventions argues that many current filings fall short, because they disclose only high level architectures and omit crucial information about datasets, training regimes and evaluation conditions, thereby weakening the patent bargain.[78]

At the same time, AI patent policy in developed nations now interacts closely with emerging regulatory regimes for trustworthy AI. The EU Artificial Intelligence Act introduces a risk based regulatory framework for AI systems and imposes obligations on data governance, transparency and post market monitoring that can influence how AI technologies are engineered and documented.[79] In the United States, Executive Order 14110 on safe, secure and trustworthy AI directs agencies to promote innovation while addressing national security and civil rights risks associated with advanced AI models.[80] The OECD Recommendation on Artificial Intelligence endorses principles of transparency, robustness and human centered values for AI development and deployment, and these values increasingly inform debates on the scope and limits of intellectual property in the AI domain.[81]

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[76] Eur. Patent Office, Guidelines for Examination in the European Patent Office pt. F III, 1–3 (2025), https://www.epo.org/en/legal/guidelines-epc/2025/f_iii_1.html.
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[79] Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 Laying Down Harmonised Rules on Artificial Intelligence, 2024 O.J. (L 206) 1, https://eur-lex.europa.eu/eli/reg/2024/1689/oj.
[80] Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, Exec. Order No. 14,110, 88 Fed. Reg. 75,187 (Nov. 1, 2023), https://www.federalregister.gov/documents/2023/11/01/2023-24283/safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence.
[81] OECD, Recommendation of the Council on Artificial Intelligence, OECD/LEGAL/0449 (May 22, 2019), https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449.

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